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NEW BOPYRID ISOPOD PARASITIC ON *CALLIANASSA UNCINATA* H. MILNE EDWARDS: WITH FUNCTIONAL AND ECOLOGICAL REMARKS.

NUEVO ISOPODO BOPIRIDO PARASITO DE *CALLIANASSA UNCINATA* H. MILNE EDWARDS: COMENTARIOS FUNCIONALES Y ECOLOGICOS

José Stuardo*, René Vega* and Iván Céspedes*

ABSTRACT

Callianassa uncinata Milne Edwards has been known to host two parasitic isopods in the branchial chamber: *Ionella agassizi* Bonnier, 1900 and *Ione ovata* Shiino, 1964. A third new species *Pseudione brattstroemi* is proposed and a detailed description of the female and male characteristics is given. SEM observations disclosed several morphological details, of which setae show greater differentiation; an attempt is made to describe and compare the different types showing no analogy between male and female. Some ecological and distributional observations are also discussed.

KEYWORDS: Parasite, bopyrid, morphology, Chile.

RESUMEN

Hay dos isópodos parásitos descritos en la cavidad branquial de *Callianassa uncinata* Milne Edwards: *Ionella agassizi* Bonnier, 1900 y *Ione ovata* Shiino, 1964. Se propone a la nueva especie *Pseudione brattstroemi* y se describen detalladamente las características del macho y la hembra. Observaciones hechas con microscopia electrónica de barrido demuestran detalles morfológicos, entre los cuales, los distintos tipos de setas observados muestran mayor diferenciación; se intenta describir e ilustrar a los diferentes tipos, concluyéndose que no hay analogías entre los de machos y hembras. Se discuten también observaciones sobre la ecologia y distribución de las 3 especies.

INTRODUCTION

Four species of the family Bopyridae have so far been recorded in Chilean waters: *Pseudione tuberculata* Richardson, 1904, taken off Port Ortway at a depth of 1050 fathoms on *Neolithodes diomedae* (Benedict); *Pseudione paucisecta* Richardson, 1904, found also off Port Ortway on *Munida curvipes* Benedict; *Stegophryxus thompsoni* Nierstrasz and Brender à Brandis, 1931, from Chile (Valparaíso, according to Markham, 1974 who reexamined the types) taken on "*Pagurus sp.*"; *Ionella agassizi* Bonnier, 1900 previously known only from Puerto Montt (Shiino, 1964) found on *Callianassa uncinata* and *Ione ovata* Shiino, 1964 from the same locality and host. To this list we can add *Pseudione galacanthae* Hansen, 1897, originally recorded on the west coast of North America but also reported by Richardson (1904) off the east coast of Patagonia on *Munida subrugosa* (White). Dr. Bourdon, the well known specialist from Roscoff, France has very kindly informed us that he has identified this species from samples of *Munida gregaria* (Fabricius) collected at San Valentin, Golfo de Penas (46°48'S-74°31'W) and *Munida subrugosa* taken at Seno Otway, Magallanes, both Chilean localities.

A study of the interrelationship of sublittoral benthic species at Coliumo Bay, central Chile (36°32'S-72°56'W) has shown the presence of a new bopyrid parasitic on *Callianassa uncinata*. Collateral sampling in the low intertidal zone, permitted the collection of the

*Departamento de Oceanología Universidad de Concepción, Concepción, Chile.

other two listed species parasitizing the same host.

This paper provides a detailed description of the new species, a discussion of the possible function of some morphological features found on mature specimens and ecological remarks. Information on larvae will be published elsewhere.

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MATERIAL AND METHODS

The parasitized specimens of *Callianassa uncinata* were collected in the intertidal zone, using a pump at low water and a 0.1 m^2 Smith-McIntyre grab in subtidal sampling. The parasites were fixed in 5% formalin and transferred to 70% ethanol after two or three days; however, as these samples partly collapsed under treatment for SEM, later specimens were directly fixed in 25% glutaraldehyde.

Both parasite and host were measured and the position of the parasite on the right or left chamber registered. Measurements included length of the carapace, for the host and maximal length excluding uropods, maximal width, head length, head width and length of the abdomen with and without uropods, for the parasites (Table 1).

Several male and female paratypes were prepared for Scanning Electron Microscopy, following the techniques recommended by Jones an Fordy (1971) but sometimes dried in a CO_2 critical point dryer. These samples were examined in an Autoscan U-1 Siemen ETEC and photographed on Kodak Plus-X, 21 DIN film. We thank the staff of the Electron Microscopy Laboratory of the Universidad de Concepción for help in treatment and photography of the samples.

The holotype, allotype and 12 paratypes including males are deposited at the Museo de Zoología, Universidad de Concepción (MZUC). Two female parasites with males were sent to the National Museum of Natural History, Washington and the Zoological Museum, Copenhagen.

Pseudione brattstroemi spec. nov.

MATERIAL EXAMINED. A total of 15 females and 11 males constitute the type series, all obtained at Coliumo Bay in the following dates and field conditions:

1. Two females without eggs: 1 adult partly damaged and 1 juvenile. Station 3. Grab, 5-6 m; sand. December 9, 1982. Paratypes MZUC 8042, 8043.
2. One adult female without eggs. Station 4. Grab, 11 m; mud. August 9, 1983. Paratype MZUC 8044.
3. One adult female with embryos and 1 male. Station "11". Grab, 11.5 m; sand. August 25, 1983. Paratypes MZUC 8045.
4. Two juveniles: 1 female and 1 male. Station "10". Grab 10 m; sand, August 25, 1983. Paratypes MZUC 8046.
5. One female without eggs. Station 11. Grab, 3 m; sand. December 27, 1983. Paratype MZUC 8047.
6. Five adult females (2 with embryos, 1 with eggs) and 5 males. Intertidal at low water; sand. October 4, 1984. This lot includes the holotype MZUC 8051, the allotype MZUC 8052 and paratypes MZUC 8048, 8049, and 8053.
7. Two females (1 with epicaridea) and 2 males. Intertidal at low water; sand. October 18, 1984. Paratypes MZUC 8054 and 8055.
8. Two females (1 with embryos) and 2 males. Fishing gear, 4 m; sand. October 24, 1984. Paratypes MZUC 8056 (sent to the Smithsonian Institution, Washington) and MZUC 8057 (sent to the Zoological Museum, Copenhagen).

Measurements of parasites and hosts are given in Table 1.

DESCRIPTION. *Female* (Figs. 1, 2; Pl. 1). Body shape ovate with round crenated borders. Dorsal and ventral surfaces convex. Ventral surface largely scaly. Body only slightly asymmetrical, with both sides more or less well developed. Body regions and segments clearly delimited with no abrupt changes in length. All pereopods present. Posterior part excluding lateral plates, abruptly narrower than the anterior half. Whitish semitransparent in life; pinkish in alcohol, without pigment.

TABLE 1

PARASITES AND HOST'S MEASUREMENTS (MM)
(L = LEFT BRANCHIAL CHAMBER, R = RIGHT BRANCHIAL CHAMBER)

FEMALE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Maximal Length	3.00	12.4	15.7	12.9	4.0	7.70	13.5	11.7	15.9	15.1	12.2	18.1	14.4	13.8	12.1
Length without uropoda	2.40	9.2	11.9	9.5	2.9	5.30	10.7	9.5	11.1	11.0	9.3	13.8	10.9	11.7	10.0
Maximal Width	1.50	7.6	11.0	7.5	2.1	3.60	8.5	8.2	8.4	9.8	8.7	11.4	10.7	9.3	9.0
Head Length	0.45	1.8	2.5	1.6	0.65	1.00	2.1	2.0	2.0	2.4	1.8	3.1	2.2	2.2	1.9
Head Width	0.80	2.6	3.7	2.5	0.85	1.40	2.9	3.0	2.5	3.0	2.4	3.4	3.1	2.4	2.6
Abdomen length:															
—with uropoda	1.40	5.2	7.0	5.4	4.5	3.40	5.8	6.3	6.0	6.8	6.6	8.0	6.5	6.1	5.3
—without uropoda	0.80	2.5	2.6	2.4	2.1	1.30	2.5	3.9	3.0	2.5	3.3	6.0	2.2	3.3	2.5
MALE															
Maximal Length	—	—	—	4.50	3.0	—	4.9	4.4	5.5	6.0	4.9	6.5	4.8	5.3	4.8
Head Length	—	—	—	0.30	0.30	—	0.4	0.2	0.45	0.65	0.45	0.5	0.5	0.4	0.5
Head Width	—	—	—	0.90	0.70	—	1.0	1.05	1.00	1.2	1.05	1.3	1.05	1.05	1.15
Pereion Width (maximal)	—	—	—	1.00	0.90	—	1.6	1.45	1.5	1.65	1.5	2.0	1.65	1.6	1.5
Abdomen Length	—	—	—	1.70	1.25	—	2.1	1.8	2.1	2.4	2.0	2.4	2.0	1.9	1.9
Abdomen Width	—	—	—	1.10	0.95	—	1.7	1.65	1.75	1.85	1.6	2.0	1.7	1.7	1.7
Museum Number (MZUC)	8042	8043	8044	8045	8046	8047	8048	8049	8050	Holotype & Allotype	8053	8054	8055	8056	8057
HOST															
Carapace Length	5.10	—	—	14.5	6.8	13.4	15.6	11.1	17.2	18.9	15.5	17.7	19.8	16.7	16.0
Parasite position	L	—	—	L	R	L	L	R	R	R	L	L	L	R	L

Cephalon wider anteriorly, symmetrical, broadly oval, deeply immersed in pereon; frontal lamina well developed, broad, with frontal and lateral extensions projecting slightly beyond the upper margin of head. No eyes present. Mouth placed behind the antennae (Pl. 1, Fig. 1). Antenna 1 (antennule, Pl. 1, Fig. 1) of 3 segments, each considerably smaller than that proximal to it. Proximal segment massive, ventrally formed by a broad basal plate with 2 prominent processes (lobes), densely covered with small fringed scales lacking only along a corrugated interlobal area; pair of proximal segments in close contact. Middle segment with sparser scales appearing more dense only on the anterior and posterior margins; isolated setae or pairs of setae close to the distal end. Distal segment non scaly, with about 6 subterminal and a group of 6-7 strong terminal setae (Pl. 1, Fig. 3).

Antenna 2 (Pl. 1, Fig. 1) with 5 segments. A very broad basal plate forms the proximal segment being separated into a flattened somewhat concave posterior area and a prominent anterior part divided by a shallow concavity; all parts densely covered with small fringed scales intermingled with small thin setae along the concavity and the lower part of the segment. Following segments, progressively smaller, elongated. Second segment densely covered with scales except around the distal end; there are small thin setae irregularly intermingled with the scales and 2 larger distal setae; scales along the posterior border elongated, with a group of large spine-like scales projecting on its distal half. Third segment cylindrical, with a set of short setae close to the distal end and a scaly posterior margin; remaining parts appearing denuded with very sparse isolated scales and thin setae. Fourth segment with a distal terminal group of 7 long setae and 3 isolated ones sparsely distributed on its second half; with some scales on the central part of its posterior margin. Terminal segment with about 4 subterminal and 3 long distal setae.

Maxilliped (Figs. 5, 6) bearing a tiny palp (Pl. 1, Figs. 1, 2) on the antero medial corner, distally tipped with nine terminal setae, aesthetasc-like (Pl. 1, Fig. 7) and joined to a tiny lateral process with 4 ones. Posterior ventral border with a long, tuberculate, pointed lateral process laterally delimiting a series of ventral digitate protuberances of the cephalon.

Pereon (Figs. 1, 2) broadest across third pereomere. Lateral borders of all pereomeres divided into anterior and posterior lobes. First 4 anterior lobes with prominent bosses clearly separated from the coxal plates which grow progressively larger posteriorly; last plate ventrally tuberculate. Posterior lobes very prominent in the second, third and fourth pereomeres, and very reduced in the next 3. Coxal plates and posterior lobes with crenulated margins (Pl. 1, Fig. 9).

Pereopods (Figs. 7-10; Pl. 1, Fig. 9). 1-7 nearly of the same size, with reduced dactylus and a large external tuberculated mass on the basis. Projecting margin of ischium, merus and carpus scaly. Distal area of carpus bearing short smooth setae (Pl. 1, Fig. 8). Five pairs of oostegites form a very broad closed pouch. Oostegite 1 (Fig. 3, 4) with a prominent external medial crest delimiting a shallow groove; rounded anteriorly, slightly pointed and incurved postero-laterally; internally bears prominent digitations near the medial line.

Oostegite 5 (Pl. 1, Fig. 4) with posterior border regularly fringed by long thin setae. External surface of all oostegites finely verrucose due to tiny scaled lumps. (Pl. 1, Figs. 5, 9).

Pleon of 6 pleomeres clearly set off from each other, with pleonal terga produced into lanceolate, tuberculate pleural lamellae approximately of the same size as the pleopods. Foliaceous birramous pleopods (Figs. 13, 14) on the first 5 pleomeres extending little or not beyond the lateral plates; with prominent tubercles on the lower face, also observable through the transparent upper part; exopodites of about the same size as the endopodites. Uropods (Figs. 11, 12) similar to the biramous pleopods.

Male (Figs. 15, 16; Pl. 2). Body slender, almost one fifth as broad as long. Body regions clearly differentiated; segments separated by strong lateral incisions.

Cephalon roughly oval, broader than long. Pigmented slits resembling eyes always discernible, obliquelly placed on anterior half. Mouth (Pl. 2, Fig. 7) behind the antennae, bearing palps.

Antenna 1 (antennule; Pl. 2, Figs. 1, 5) of 3 segments, each extremely different in size to

the next. Terminal segment (flagellum; Pl. 2, Figs. 3, 4) with a group of about 11 terminal setae and 1 lateral, isolated. Second segment massive, cylindrical with a set of 8 distal setae: 4 simple and 4 (2 on each side) branched. Basal segment obliquely bent with strong scales on its anterior part and around the internal and ventral parts; 2 subdistal setae and small thin setae appear intermingled with the scales.

Antenna 2 (Pl. 2, Fig. 1) of 5 segments; basal segment short but massive forming a ventral protuberance heavily covered with projecting scales and thin setae; second segment longest, laterally compressed, with 1 long distal seta, many scales and intermingled small thin setae along its ventral border; third segment short with only one long distal seta; fourth segment almost twice as long as the third with a constriction around the first third of its total length indicated by groups of setae; a triangular area with 9 long setae, distally placed while other isolated setae surround the base of the terminal segment; fifth segment narrower than preceding one, cylindrical, almost as long as the third segment, with a ring of subterminal long isolated setae and a group of about 13 terminal ones, 2 appearing extremely long (Pl.2, Fig. 2).

Pereon with segments roughly rectangular, narrow, of similar breadth, separated by deeply incised (*pinnatiscisus*) margins. No medioventral tubercles are observable. Pereopods of nearly same size but with segments proportionally different.

Pereopods 1-3 (Pl. 2, Fig. 10) similar, with well developed dactylus and short merus and carpus. Posterior margins of the ischium, merus and carpus with small projecting scales and thin short setae, sparsely distributed. Carpus bearing a flat distal area with projecting fringed scales and groups of simple setae (Pl. 2, Fig. 9). Palmar surface of the propodus expanded with a row of 5 stout cuspidate-like setae (Pl. 2, Fig. 8) and a proximal process also with fringed scales. Pereopods 4-7 (Pl. 2, Fig. 11) with small rudimentary dactylus and very elongated carpus; posterior margins of ischium, merus, carpus and anterior border of base segment, scaly.

Pleon of six well developed pleomeres; first 3 or 4 larger than the pereomeres, becoming progressively smaller towards the end. Uropods similar in shape to the remaining pleomeres but smaller; no medio-ventral tubercles or pleopods present.

TAXONOMIC REMARKS. *Pseudione brattstroemi spec. nov.* seems to have its closest relative in *Pseudione tuberculata* Richardson. Both are rather symmetrical species, but *P. brattstroemi* can be easily differentiated by its larger foliaceous pleopods, distinctly crenated borders and overall larger pereonal region of the female. The male of the new species is also utterly different with narrow pereonal segments and wider pleonal ones, all deeply incised.

The epicaridium and cryptoniscus larvae of the new species to be described elsewhere have no morphological features in common with either the adult male or female.

The new species is named after Professor Hans Brattström of Norway, one of the leaders of the Lund University Expedition to Chile (1948-49) whose editing efforts contributed so much to the knowledge of the Chilean fauna.

MORPHOLOGICAL REMARKS. Few studies using scanning electron microscope seem to have been done on adult bopyrids, although its advantages had already been demonstrated in a study of the male of *Hemiarthrus abdominalis* (Kröyer) by Jones (1974).

As pointed out by Kensley (1982), not all taxonomists may have access to this instrument; however, its use in the interpretation of fine details of surface integument, appendages and sensory structures in small sized species and particularly in larvae, becomes indispensable as shown by Goudeau (1970) and Nielsen and Strömberg (1973a, b) for the larvae of some Cryptoniscina and Dale & Anderson (1982) for the larvae of *Probopyrus*.

The study of the functional morphology of appendages used in grooming in several crustaceans (Felgenhauer and Schram, 1979; Holmquist, 1982) and setal differentiation used as chemoreceptors, mechanoreceptors and sensory structures in general (Fish, 1972; Farmer, 1974; Snow, 1974) is of similar importance. However, the differences observed among the groups of the above named crustaceans and even between related species are so great that the structures characterized in our

descriptions, or figures, not having clear similarities with supposedly homologous ones, are cautiously named and, in general, tentatively assigned to a purported function. Undoubtedly studies are needed on their ultrastructure and function, coupled with observations on species behaviour.

Among the first structures deserving further study, are the various types of setae observed in the male and female of the new species. There are at least five different morphological types present in the female and as many in the male. Some of them, however, are definitely different in both sexes. This should not be so surprising given the different postcryptoniscus developmental pattern of the almost immobile female compared to that of the male.

The types of setae found in the female are:

Type 1. Long large setae with extended basal annulation (35 μm); found apically on the terminal segment of antenna 1 (Pl. 1, Figs. 1, 3).

Type 2. Long large setae with short basal annulation (27-31 μm); distributed on the apical parts of segment 4 and 5 of the antenna 2 (Pl. 1, Fig. 1).
Short setae of a similar type are found on the distal field of the carpus in all pereopods (Pl. 1, Fig. 8).

Type 3. Short large setae; subterminal ones present on the 2nd segment of the first antenna (17-19 μm) and on the 3rd segment of the second antenna (25 μm) (Pl. 1, Fig. 1).

Type 4. Short thin setae with irregular constrictions (18-22 μm); sparsely distributed and intermingled with scales on the 3rd and basal segment of the second antenna (Pl. 1, Figs. 1, 6).

Type 5. Long papillose setae (125-237 μm) found on the palp and adjoining lateral process of the maxilliped (Pl. 1, Figs. 1, 2, 7).

Type 6. Very long, smooth, extremely thin tipped setae (520-600 μm); fringing the distal border of the oostegites (Pl. 1, Fig. 4).

In turn, the types of setae found in the male are:

Type 7. Long large setae with ill-defined basal annulation.
Here belong those found distally on the terminal segment and second segment of antenna 1 (antennule) (26-31 μm) and apically on the segments 3, 4 and 5 of antenna 2 (33-66 μm) (Pl. 2, Figs. 1, 2, 3, 4, 5).

Type 8. Short large setae; subterminal ones, found near the apical border of the basal segment of antenna 1 (12.5 μm) and the second segment of antenna 2 (29 μm).
Short setae found on the distal field of the carpus in all pereopods appear to be similar (21.6-25 μm) (Pl. 2, Figs. 1, 5, 6, 9, 10).

Type 9. Short setae with inflated hemispherical base (21-22 μm). These peculiar setae are found only on the palmar surface of the propodus of the first 3 pairs of pereopods (Pl. 2, Figs. 8, 10).

Type 10. Long flat bearded setae with extended basal annulation (46-51 μm); found only on middle segment of antenna 1 (Pl. 2, Figs. 1, 5).

Type 11. Small thin setae (8-12 μm); sparsely distributed on the basal segment of antenna 1, the posterior border of the first 3 segments of the pereopods and the pereonites (Pl. 2, Figs. 5, 10).

We hesitate to assign any given functional character to the various types here recognized. Obviously the great morphological differences shown at least by some of these types, suggest different functional roles, but they do not show clear or apparent similarities with any of the types described for Astacidae (Thomas, 1970), Paguridae (Snow, 1974), Nephropsidae (Farmer, 1974), Amphipoda (Dahl *et al.*, 1970; Dahl, 1973; Holmquist, 1982), other Isopoda (Schultz, 1969; Fish, 1972) and least of all the parasitic larval stages of the Epicaridea (Nielsen and Strömberg, 1973 a, b; Goudeau, 1970).

Furthermore, this list shows that besides the overall differences in shape and size, there are also differences between the sensilla of male and female of the same species of parasitic isopod, although in some cases simple difference in size might not be indicative of different function. For instance, it is generally assumed that setae present in the antennules (here antenna 1) and antennae (here antenna 2) have sensorial function. Among these, "aesthetascs" have been described in other crustaceans with or without annulation, with or with-

out terminal pores and arranged differently along the two pairs of antennae. Typical aesthetascs are also found in the peculiar antenna 1 of the cryptoniscid larvae, but no such type of setae has been observed in the adult male or female.

In the specimens studied, the setae of types 7 and 8 show a terminal pore (0.23-0.36 μm) which although surrounded by a ring, does not show an overhanging shield or flap sometimes observed in the setae of other crustaceans, but opposes a small knob distinctly noticeable at different angles. The same terminal arrangement is present in the setae found on the distal field of the carpus.

Similar pores seem to be present in the female setae of types 1 and 2, including the short setae found on the distal field of the carpus in all pereopods. At least the latter become analogous with those observed in the pereopods of the male, possibly serving as mechanoreceptors in the clasping position. The setae of type 9 in the male are undoubtedly mechanoreceptors but whether they aid in grasping or play a function in grooming has not been ascertained.

In a host gently pressed to the bottom of a bowl we have followed for hours the male movements and observed that, at least in this species, the male can temporarily abandon the female and move around the branchial cavity of the host, even reaching to the opposite non parasitized branchial chamber. In moving around he does not use the first pairs of pereopods, usually clasping the female pleopods, or other parts, with the last four pairs in which the dactylus become reduced and no setae of type 9 are present.

Features equally conspicuous are the different types of scales largely covering the ventral anterior half of the female, specially on the appendages, their surrounding areas and the projecting parts of the basis, ischium, merus and carpus of the pereopods. There is a basic type with either smooth or fringed distal borders, another extremely elongated form localized on the second segments of the antenna 2 and a third very wide type covering the ventral surface of the cephalon. Their greater size and abundance in ventrally projecting areas of the basal segments of the antennae, suggest a possible use as abrasive surfaces; but their function in the other places, if any, remains speculative.

On the male, the scales are restricted to parts of the basal segments of the 2 pairs of antennae and the projecting parts of the pereopods, including the palmar surface of the propodus opposing the dactylus, where in combination with the short setae of type 9, might effectively be used in grooming to facilitate scraping and brushing of at least the antennae, as described particularly by Holmquist (1982) for talitroidean amphipods.

ECOLOGICAL AND DISTRIBUTIONAL REMARKS. *Callianassa uncinata* H. Milne Edwards, host of the new species, is the only burrowing shrimp found subtidal —as well as intertidally— in the sandy bottoms of Coliumo Bay, being scarce in fine sand and/or silt. Although no populational study of this shrimp has been undertaken, on the average its abundance is about 20 adult and juvenile specimens per m^2 in heavily populated areas.

As mentioned earlier, this seems to be one of the few cases of a host parasitized in the same area by 3 different bopyrid parasites and it rises questions on the modalities of competition and adaptation developed by the larvae and adult of one or the other of the three species involved. During the study we have learned that while only *Pseudione brattstroemi spec. nov.* is found subtidally from about 4 to 18 m depth, the 3 species can be found intertidally with frequent predominance of *Ionella agassizi* and rare appearance of *Ione ovata*.

No record of these parasites for the two other callianassid species also found in continental Chile has been published. *Callianassa brachiophthalma* Milne Edwards known only from southern Chile (Chiloé Island and Bahía Ralún, Seno Reloncaví) lives subtidally. An examination of 168 specimens by Holthius (1952) did not yield parasites although this author was the first to mention in the same paper the presence of a *Ione* sp. in *C. uncinata*. The larger shrimp *Callianassa garthi* Retamal is also known from central Chile but seems to prefer open areas exposed to rough wave action and has not been found in the Bay of Coliumo. An examination of about 17 specimens and paratypes did not show parasites, but verification of the presence or absence of

any of the parasites on *C. garthi* and *C. brachiophthalma* through seasonal sampling and populational studies is necessary for understanding all possible implications.

Bottom sampling for about one year has disclosed that for every 5 or 6 juveniles of *Callianassa uncinata* there is usually only one parasitized, that is about 20% of the population. The average ratio for 4 samples totalling 170 adults is only 10% of parasitized hosts.

These percentages indicate that parasitization is not high throughout the year and as a first approach, they agree with figures given by Pike (1960) for the Firth of Clyde, England for *Pseudione affinis* parasitizing adult *Pandalus bonnieri* (11.4-18.4% from 1724 prawns) and *Hemiarthrus abdominalis* parasitizing adult *Spirotoncaris lilljeborgii* (11.7-18% from 1372 prawns).

Since a close search for juvenile parasites and cryptoniscus stages in all adult burrowing shrimps studied was fruitless, we also agree with Pike (*op. cit.*) that parasitization takes place only in the early post-larval and juvenile stages of *Callianassa uncinata*.

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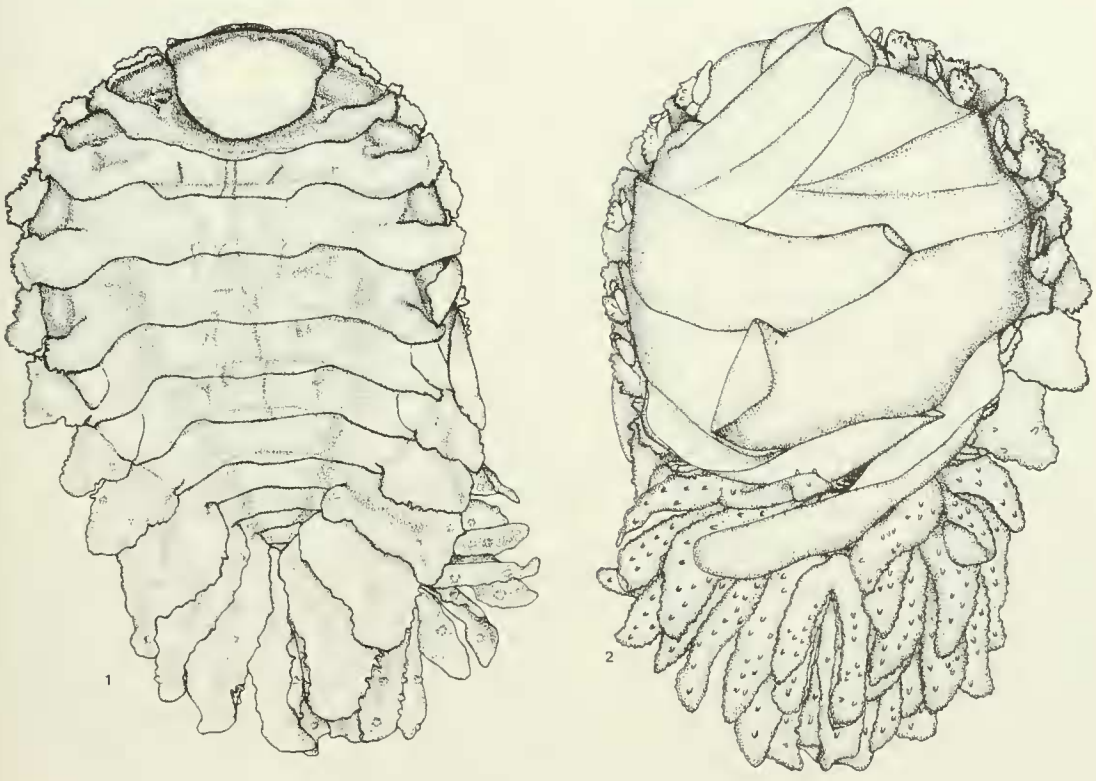

FIG. 1-2. *Pseudione brattstroemi* spec. nov. Female paratype MZUC 8044. 1) Dorsal view; 2) ventral view. Magnification: 1.2 × 6.3.

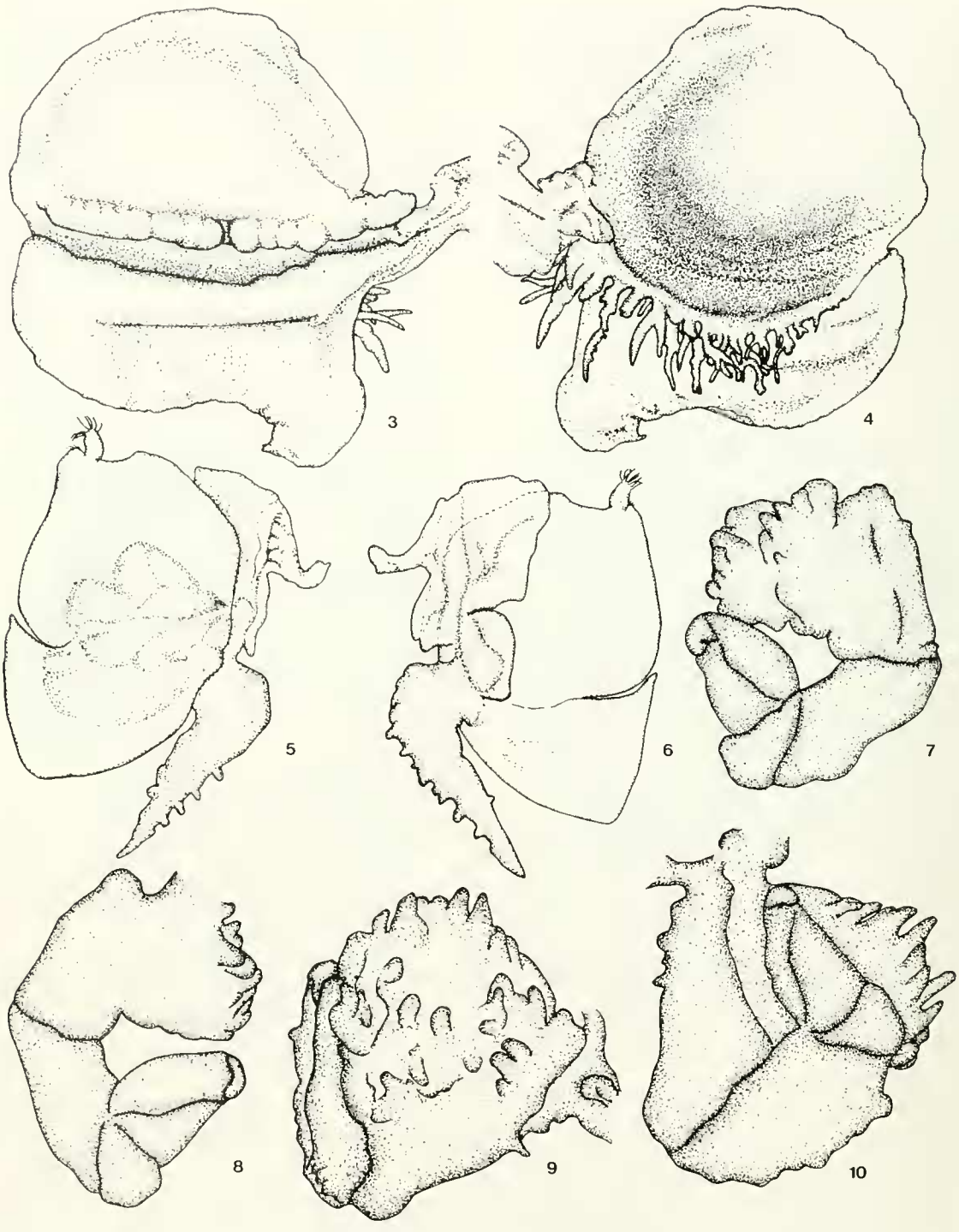

FIG. 3-10. *Pseudione brattstroemi* spec. nov. Female paratype MZUC 8044. 3) First left oostegite (outer view); 4) same, inner view; 5) Left maxilliped, outer view; 6) same, inner view; 7) First left pereopod, outer view; 8) same inner view; 9) Seventh left pereopod, outer view; 10) same, inner view. Magnification: 3, 4, 5, 6 × 13; 7, 8, 9, 10 × 26.

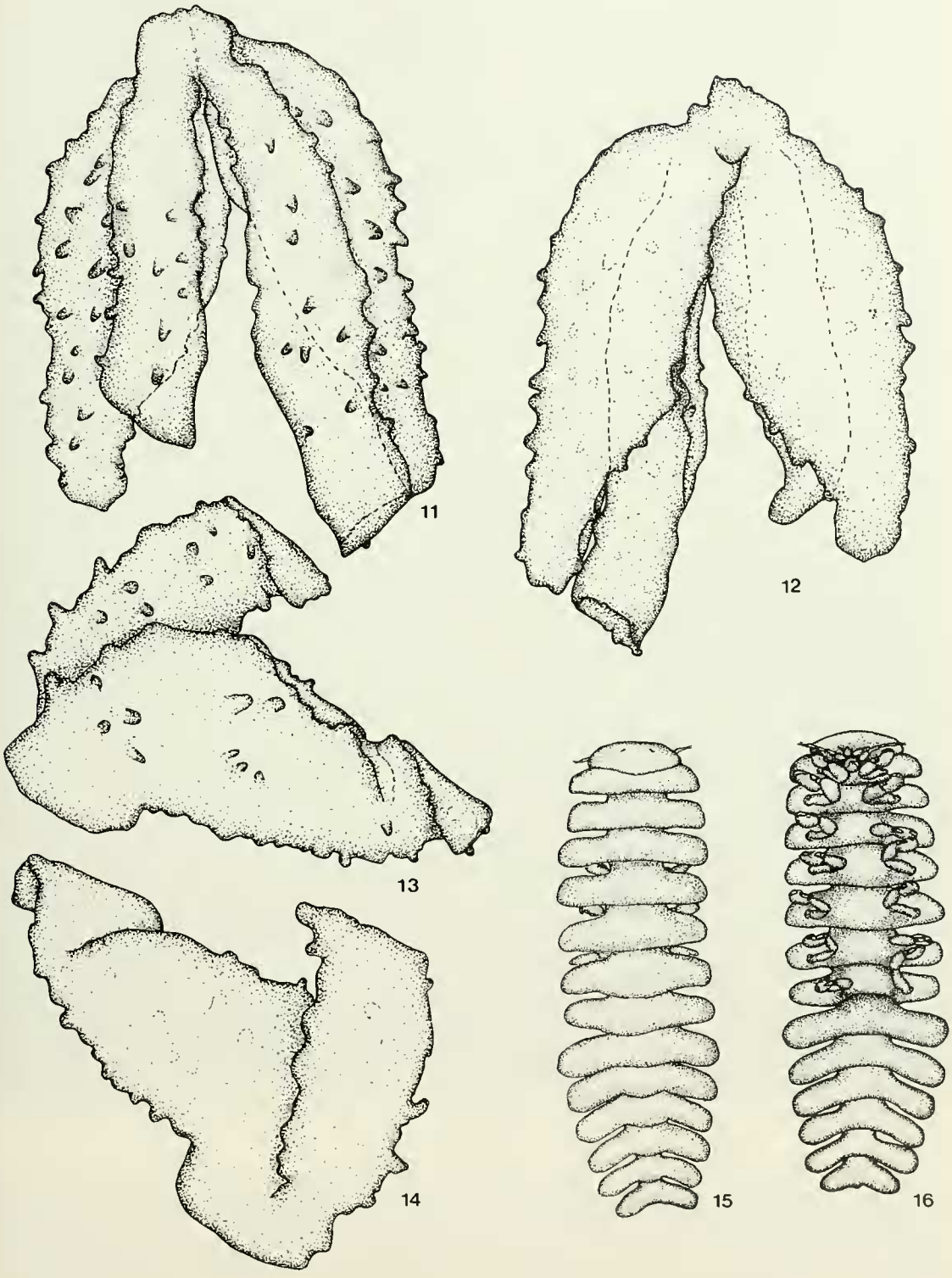

FIG. 11-16. *Pseudione brattstroemi* spec. nov. 11-14. Female paratype MZUC 8044. 11) Pleotelson and uropods, outer view; 12) same, inner view; 13) First left pleopod, outer view; 14) same, inner view; 15-16, Male paratype MZUC 8050. 15) dorsal view; 16) ventral view. Magnification: 11, 12, 13, 14 × 21, 15, 16 × 13.6.

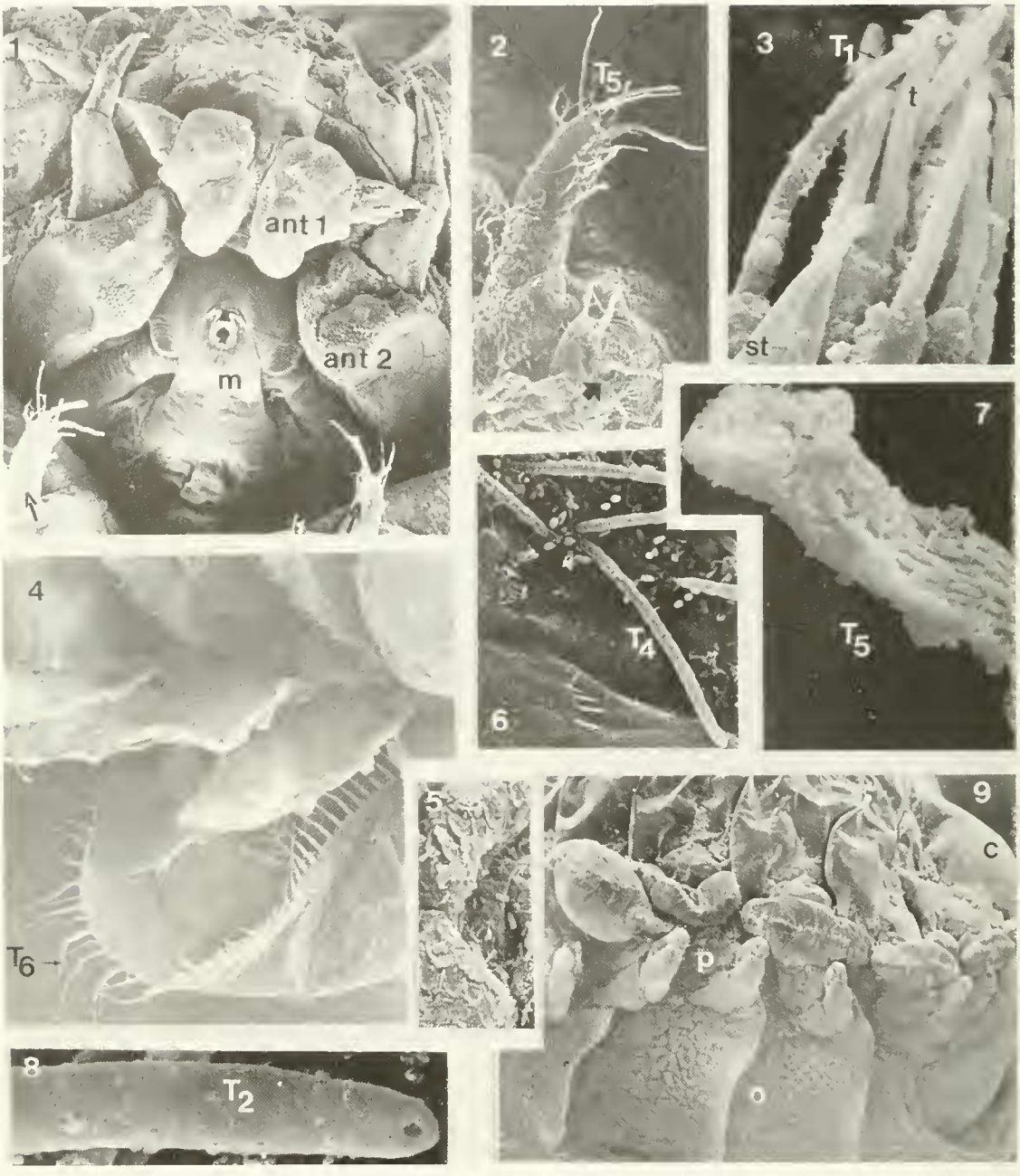

Plate 1.

Pseudione brattstroemi spec. nov. Female. Types of setae (see text), differentiated as T_n...

1) anterior ventral view showing the antennules (ant. 1), antennae (ant. 2), modified mouthparts (m) and palps of the maxilliped (arrows), × 42; 2) outer view of the palps; note the lateral process with four setae (T_5, arrow), × 80; 3) distal segment of the antennule showing subterminal (st) and terminal (t) setae (T_1) × 2470; 4) lateral view of pleopods and fifth oostegite showing long thin setae (T_6, arrow), × 25; 5) detail of tiny scaled lumps on oostegite, × 240; 6) detail of third segment of antenna 2, showing small setae (T_4), × 2200; 7) tip of maxilliped's palp terminal seta (T_5, aesthetasc ?), × 4000; 8) tip of seta (T_2) in carpus of second pereopod, × 8400; 9) lateral view of pereon showing pereopods (p), oostegites (o) and cephalon (c).

FIG. 1, 2, 3, 6, 7 and 9 belong to paratype MZUC 8054; 4, 5 and 8 to paratype MZUC 8047.

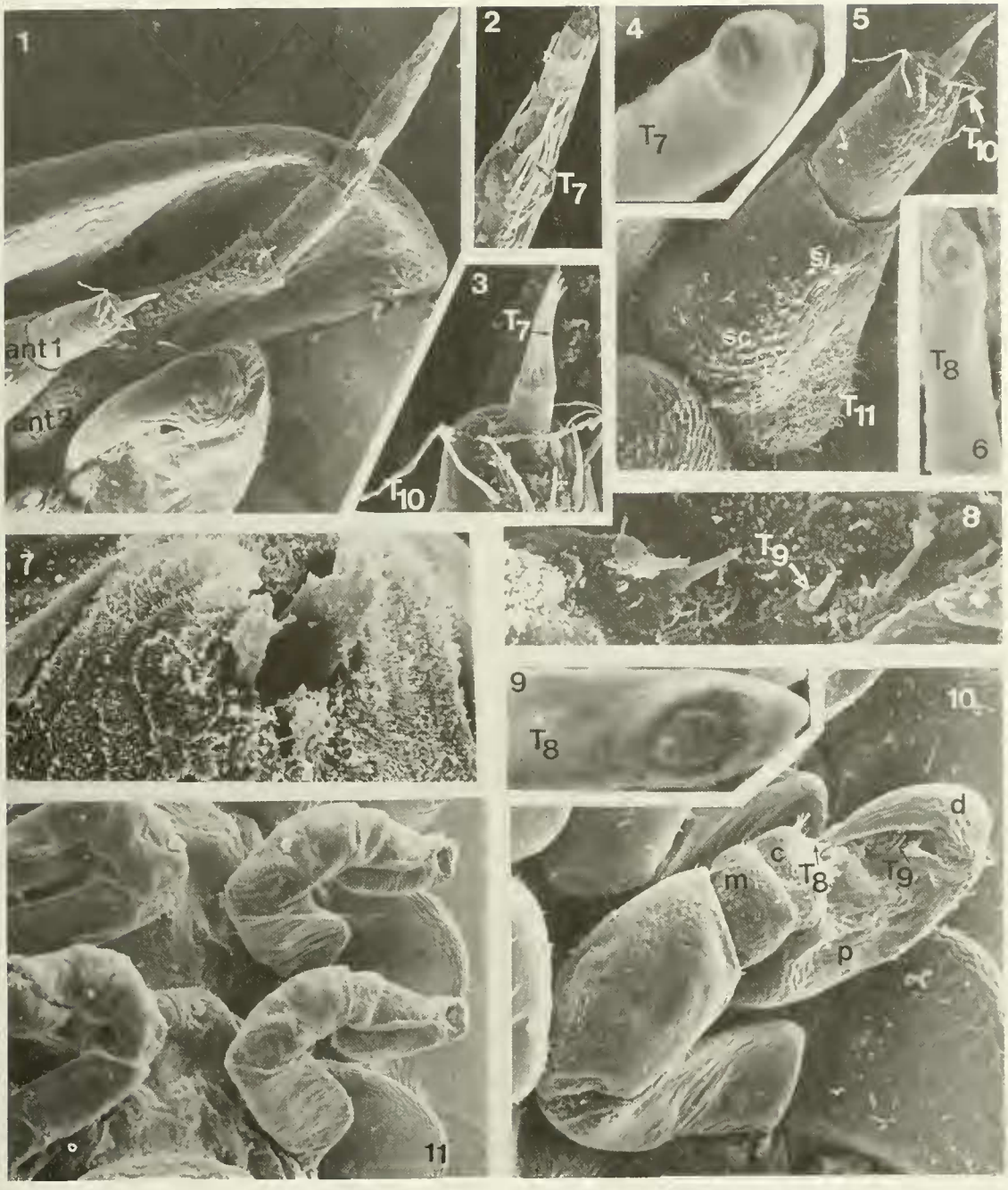

Plate 2.

Pseudione brattstroemi spec. nov. Male. Types of setae (see text), differentiated as T_n...

1) antero-lateral ventral view showing part of the cephalon, antennule (ant. 1), antenna (ant. 2) and first pereopod, × 120; 2) fourth and distal segments of antenna 2 with terminal and subterminal setae, (T_7) × 300; 3) distal segment of antennule with terminal setae, (T_7, T_{10}) × 450; 4) tip of terminal setae, (T_7), found on the distal segment of antennule, × 16800; 5) left antennule showing simple setae (T_8, s), branched setae (T_{10}, arrow) and scales (sc), × 240; 6) tip of distal setae (T_8) found on the antennule's basal segment, × 8400; 7) mouth, × 900; 8) propodal palmar surface of first pereopod showing stout cuspidate-like setae (T_9, arrow), × 800; 9) carpal seta of first pereopod (T_8) showing pore's secretion, × 16800; 10) second left pereopod; arrows indicate main types of setae (T_8, T_9) (p is propodus, c is carpus, m is merus, d is dactylus), × 102; 11) ventral view of sixth and seventh pair of pereopods, × 50.

FIG. 1, 2, 3, 5, 7, 8, 10 and 11 from paratype MZUC 8054; 4, 6 and 9 from paratype MZUC 8045.